AN 08-30CRN10-2

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HANDBOOK OF OPERATING INSTRUCTIONS

for

RADIO SET AN/CRN-10

RESTRICTED
(For Official Use Only)

Approved 13 OCTOBER 1944

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Destruction of Abandoned Materiel in the Combat Zone

In case it should become necessary to prevent the capture of this equipment and when ordered to do so, DESTROY IT SO THAT NO PART OF IT CAN BE SALVAGED, RECOGNIZED, OR USED BY THE ENEMY. BURN ALL PAPERS AND BOOKS.

Means:—

1. Explosives, when provided.
2. Hammers, axes, sledges, machetes, or whatever heavy object is readily available.
3. Burning by means of incendiaries such as gasoline, oil, paper, or wood.
4. Grenades and shots from available arms.
5. Burying all debris or disposing of it in streams or other bodies of water, where possible and when time permits.

Procedure:—

1. Obliterate all identifying marks. Destroy nameplates and circuit labels.
2. Demolish all panels, castings, switch- and instrument-boards.
3. Destroy all controls, switches, relays, connections, and meters.
4. Rip out all wiring and cut interconnections of electrical equipment. Smash gas, oil, and water-cooling systems in gas-engine generators, etc.
5. Smash every electrical or mechanical part, whether rotating, moving, or fixed.
6. Break up all operating instruments such as keys, phones, microphones, etc.
7. Destroy all classes of carrying cases, straps, containers, etc.
8. Bury or scatter all debris.

DESTROY EVERYTHING!

Unsatisfactory Report

For U. S. Army Air Force Personnel:

In the event of malfunctioning, unsatisfactory design, or unsatisfactory installation of any of the component units of this equipment, or if the material contained in this book is considered inadequate or erroneous, an Unsatisfactory Report, AAF Form No. 54, or a report in similar form, shall be submitted in accordance with the provisions of Army Air Force Regulation No. 15-54, listing:

1. Station and organization.
2. Nameplate data (type number or complete nomenclature if nameplate is not attached to the equipment).
3. Date and nature of failure.
4. Radio model and serial number.
5. Remedy used or proposed to prevent recurrence.
6. Handbook errors or inadequacies, if applicable.

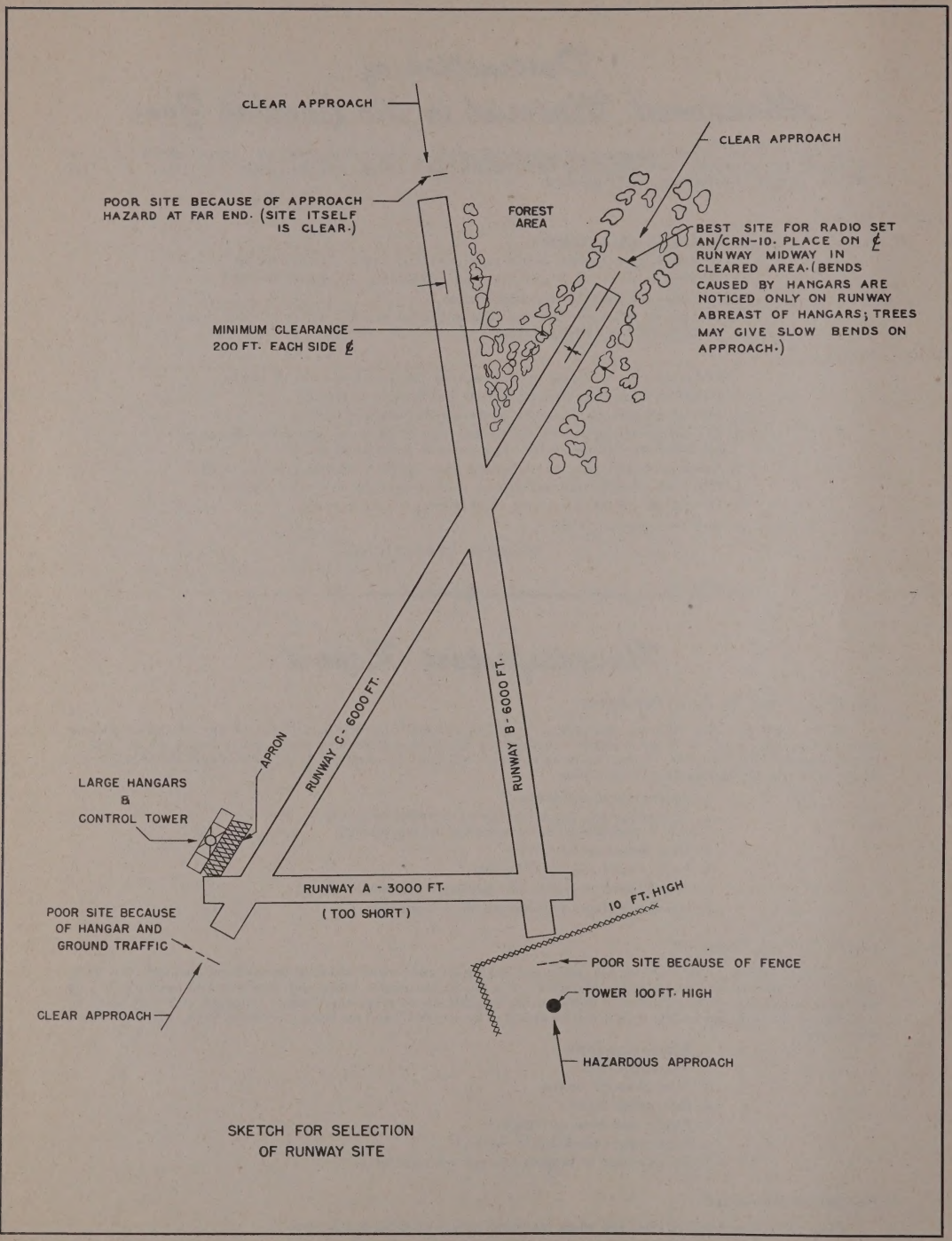
For U. S. Navy Personnel:

Report of failure of any part of this equipment during its guaranteed life shall be made on Form N. Aer. 4112, "Report of Unsatisfactory or Defective Material," or a report in similar form, and forwarded in accordance with the latest instructions of the Bureau of Aeronautics. In addition to other distribution required, one copy shall be furnished to the inspector of Naval Materiel (location to be specified) and the Bureau of Ships. Such reports of failure shall include:

1. Reporting activity.
2. Nameplate data.
3. Date placed in service.
4. Part which failed.
5. Nature and cause of failure.
6. Replacement needed (yes—no).
7. Remedy used or proposed to prevent recurrence.

For British Personnel:

Form 1022 procedure shall be used when reporting failure of radio equipment.


CLEAR APPROACH
CLEAR APPROACH
POOR SITE BECAUSE OF APPROACH HAZARD AT FAR END. (SITE ITSELF IS CLEAR.)
FOREST AREA
BEST SITE FOR RADIO SET AN/CRN-10. PLACE ON ℄ RUNWAY MIDWAY IN CLEARED AREA. (BENDS CAUSED BY HANGARS ARE NOTICED ONLY ON RUNWAY ABREAST OF HANGARS; TREES MAY GIVE SLOW BENDS ON APPROACH.)
MINIMUM CLEARANCE 200 FT. EACH SIDE ℄
RUNWAY C - 6000 FT.
RUNWAY B - 6000 FT.
APRON
LARGE HANGARS & CONTROL TOWER
RUNWAY A - 3000 FT.
(TOO SHORT)
10 FT. HIGH
POOR SITE BECAUSE OF HANGAR AND GROUND TRAFFIC
POOR SITE BECAUSE OF FENCE
TOWER 100 FT. HIGH
CLEAR APPROACH
HAZARDOUS APPROACH

SKETCH FOR SELECTION OF RUNWAY SITE

Figure 1-1. Sketch for Selection of Runway Site

SAFETY NOTICE

This equipment uses high voltages which are dangerous and may be fatal if contacted by operating personnel. Use extreme care at all times when working with this equipment. Follow instructions carefully. Interlocks are provided on the transmitter sections to disconnect all high voltage when a chassis is rolled forward. However, do not depend on these switches to furnish the complete protection.

SECTION I
GENERAL DESCRIPTION

1. GENERAL.

a. PURPOSE.

(1) Radio Set AN/CRN-10 is an air-transportable multi-frequency instrument-landing localizer. It may be used as a part of the Army Air Force Instrument Approach System and can be remotely controlled. All components of Radio Set AN/CRN-10 are contained in Trailer V-6/CRN-10 which in itself is a part of the radio set.

(2) Radio Set AN/CRN-10 is essentially a radio transmitter and a radio-frequency radiating system. The antenna system radiates two intersecting field patterns, one of which is modulated at an audio frequency of 90 cycles per second and the other at an audio frequency of 150 cycles per second. The field patterns can be oriented so that the intersection coincides with the centerline of a landing runway.

(3) Radio Set SCR-610-A, a part of Radio Set AN/CRN-10, is used for intercommunication between component parts of the instrument landing system installation.

(4) Aircraft equipped with suitable receiving apparatus are provided an "ON COURSE" indication when they are aligned with the intersection of the two field patterns. If the aircraft is flying to the left side of the course, the receiver-course meter will direct the pilot to "FLY RIGHT" to get back on the course. With the aircraft flying to the right side of the course, the meter indication would be to "FLY LEFT." Lateral guidance is provided in this manner, enabling an aircraft to be accurately aligned with the centerline of the runway under conditions of poor visibility.

b. RANGE.—The range of the equipment is a function of the altitude of the receiving aircraft and is approximately 40 miles at an elevation of 2500 feet, 60 miles at 6000 feet, and 75 miles at 10,000 feet.

c. FREQUENCY.—Radio Set AN/CRN-10 has a frequency range of 108.3 to 110.3 megacycles. It can be operated on any frequency within that range by inserting the proper crystal unit and tuning Radio Transmitter T-66/CRN-10. Crystal Units DC-17-A are provided for operation on the six frequencies 108.3, 108.7, 109.1, 109.5, 109.9, and 110.3 megacycles. These frequencies are designated on the crystals as "U, V, W, X, Y" and "Z" respectively.

d. POWER CONSUMPTION AND OUTPUT.

(1) POWER INPUT.

(a) 60 CYCLES.—During operation, the power delivered by Power Unit PU-25/CRN to the transmitting equipment is approximately one kilowatt of 60-cycle, single-phase power at 110-120 volts. In addition, a 12-volt storage battery is required for operation of intercommunication Radio Set SCR-610-A and for normal operation of the obstacle lights. The complete equipment, with the exception of Radio Set SCR-610-A can be operated from an external source of 110/120-volt, 60-cycle power only. The obstacle lights can also be operated from a 105-volt d-c runway lighting system.

(b) 50 CYCLES.—For 50-cycle power refer to section II, paragraph 11.

(2) POWER OUTPUT. — The radio-frequency power output of Radio Set AN/CRN-10 is approximately 35 watts under normal operating conditions.

2. EQUIPMENT SUPPLIED.

The following equipment is supplied.

Quantity	*Name of Unit*	*Army Type Designation*	*Navy Type Designation*	*Overall Dimensions*	*Weight (pounds)*
1	Antenna System includes:	AS-156/CRN-10	AS-156/CRN-10		
	7 Masts				
	1 Mounting Frame	MT-289/CRN-10	MT-289/CRN-10		
	8 Antenna Assembly	AS-155/CRN-10	AS-155/CRN-10		
	1 Antenna Tuning Unit includes:	TN-71/CRN-10	TN-71/CRN-10		
	1 Cord	CG-154/CRN-10	CG-154/CRN-10	64′ 11″	
	1 Cord	CG-154/CRN-10	CG-154/CRN-10	50′ 0″	
	2 Cord	CG-152/CRN-10	CG-152/CRN-10	34′ 2″	
	2 Cord	CG-152/CRN-10	CG-152/CRN-10	28′ 3″	
	2 Cord	CG-152/CRN-10	CG-152/CRN-10	19′ 9″	
	1 Cord	CG-152/CRN-10	CG-152/CRN-10	24′ 7″	
	1 Case Assembly, Air Corps Stock No. 8200-147000				
	6 Rod, AAF Part No. 36A4468				
	9 Eye, AAF Part No. 36A44669				
1	Course Detector (Portable) includes:	TS-179/CRN-10	TS-179/CRN-10		
	1 Leg	LG-16-B			
	1 Mounting	MT-229/CRN-10	MT-229/CRN-10		
1	Course Monitor (Fixed) includes:	TS-180/CRN-10	TS-180/CRN-10		
	1 Cord	CX-244/CRN-10	CX-244/CRN-10		
	1 Mounting	MT-226/CRN-10	MT-226/CRN-10		
	1 Tripod		LG-27-B		
1	Radio Transmitter includes:	T-66/CRN-10	T-66/CRN-10		
	Crystal Unit	DC-17-A (6016.66 kc.)			
	Crystal Unit	DC-17-A (6038.88 kc.)			
	Crystal Unit	DC-17-A (6061.11 kc.)			
	Crystal Unit	DC-17-A (6083.33 kc.)			
	Crystal Unit	DC-17-A (6105.55 kc.)			
	Crystal Unit	DC-17-A (6127.77 kc.)			
1	Modulator and Bridge includes:	MD-24/CRN-10	MD-24/CRN-10		
	1 Cord	CG-153/CRN-10	CG-153/CRN-10		
	1 Tube Case	CY-242/CRN-10	CY-242/CRN-10		
1	Indicator	ID-70/CRN-10	ID-70/CRN-10		
1	Voltmeter R-F (Unbalanced)	IS-176-B			
1	Trailer includes:	V-6/CRN-10	V-6/CRN-10		
	1 Chest	CY-184/CRN-10	CY-184/CRN-10		
	1 Cable Case	CY-241/CRN-10	CY-241/CRN-10		
	1 Reel Assembly	RL-107/CRN-10	RL-107/CRN-10		
	1 Obstacle Light	MX-217/CRN-10	MX-217/CRN-10		
	2 Obstacle Light Combat Hoods				
1	Set Tool Equipment				
1	Metal Tape				
1	Radio Set	SCR-610-A			
1	Chart (Operating Instructions)				

3. EQUIPMENT REQUIRED BUT NOT SUPPLIED.

The following equipment is required but not supplied.

Quantity	*Name of Unit*	*Army Type Designation*	*Navy Type Designation*	*Required Characteristics*
1	Power Unit	PU-25/CRN	PU-25/CRN	
1	Frequency Converter	PU-15/CRN-2	PU-15/CRN-2	
1	Cord	CX-345/CRN-10	CX-345/CRN-10	
1	Cord	CX-346/CRN-10	CX-346/CRN-10	

SECTION II
INSTALLATION AND ADJUSTMENT

WARNING

This equipment uses high voltages which are dangerous to operating personnel. Use extreme care when working with this equipment. Follow instructions. Interlocks are provided on the transmitter sections to disconnect all high voltages when a chassis is rolled forward. However, do not depend upon these switches to furnish the only protection.

1. GENERAL.

Installation of Radio Set AN/CRN-10 involves selecting a site, setting up Antenna System AS-156/CRN-10, and positioning of Trailer V-6/CRN-10 and making connections to it.

2. SELECTION OF SITE.

a. SELECTION OF RUNWAY. *(See figure 2-1.)*—Whenever more than one runway is available on an airport, choose that runway which will most nearly meet the following criteria:

(1) APPROACH ZONE.—The approach zone, the region through which the airplane passes at very low altitudes on its landing approach, must be clear of flight hazards such as buildings, trees, poles, etc.

(2) RUNWAY SIZE.—If two or more runways having equally clear approaches are available, choose the one with the longest runway.

(3) REFLECTION ZONES.—If a choice of runways is available, each of which is satisfactory from the standpoint of a clear approach and sufficient length, choose the runway that gives the least obstructed site for Radio Set AN/CRN-10.

(a) "ZONE A" is the area in the immediate vicinity of the antenna-array (within approximately 100 feet of it). This area must be clear of vehicular and airplane traffic.

(b) "ZONE B" is the area around the antenna array which must be clear of reflecting objects such as power-lines, buildings, trees, etc. The size of the area depends on the size and nature of the object. Small metal objects such as oil drums can be placed anywhere. Metal objects (or wooden sheds containing wires and pipes) which are no larger than Trailer V-6/CRN-10 must be no closer than 50 feet to the antenna array. One-story buildings must be at least 150 feet from the antenna array. Two-story buildings and power lines must be at least 200 feet from the antenna array. Large hangars must be at least 300 feet from the antenna array.

(c) "ZONE C" is that area in front of the antenna array which must be clear of reflecting objects; it extends approximately 25 degrees either side of the course. Reflecting objects in this area have more effect than those further from the course, but even in this region the effect is a function of distance.

There must be no moving traffic in "ZONE C" within 400 feet of the antenna array. Objects the size of Trailer V-6/CRN-10 must be at least 200 feet from the latter. One-story buildings must be at least 600 feet from the antenna array. Two-story buildings and power lines must be at least 800 feet from the antenna array. Large hangars must be at least 1200 feet from the antenna array.

Note

Always be guided by the approach zone and the runway size in choosing the runway to be served by Radio Set AN/CRN-10. The figures for minimum distances to reflecting objects quoted above are approximate and are intended only for guidance in choosing the best location. Completely satisfactory performance can be obtained even though reflecting objects are close to the antenna array. Always set up the equipment and flight-check the course for the best airplane approach available.

b. SELECTION OF LOCALIZER SITE.—When the runway has been selected, choose the exact spot for Radio Set AN/CRN-10.

(1) SELECTION OF BACKSET FOR ANTENNA ARRAY.—As shown in figures 2-1 and 2-2, Course Monitor TS-180/CRN-10 (fixed) will be closest to the runway. Approximately 150 feet behind this is to be located the antenna array. Trailer V-6/CRN-10 is to be approximately 50 feet behind the antenna array.

Whenever possible, choose the spot for the antenna array at least 1000 feet from the far* end of the runway pavement. If such a location places the antenna array too close to reflecting objects behind it, a lesser backset may be used. Use the largest backset possible, even at the expense of being closer to reflecting objects than the distances recommended for "ZONE B" in paragraph 2.*a.*(3)*(b)*, this section. A distance of only 100 feet from power lines, buildings or trees is preferable to a backset of less than 500 feet from the end of the runway.

(2) LOCATION OF RUNWAY CENTERLINE.—When the backset for the antenna array has been

*End of the runway toward which the aircraft rolls after landing.

chosen, locate the centerline of the runway as follows:

(a) Remove the 100-foot steel tape from the tool chest and five airplane mooring anchors (rods and arrows) from the antenna stowage containers. The anchors are to be used for temporary surveying markers. Locate point "A" (see fig. 2-6) at the proper backset from the runway and on the projection of the edge of the runway. To do this the radio operator (or designated helper) locates himself at the estimated proper backset, faces the runway and moves to the left and right to align himself accurately with the edge of the runway. Mark the point "A" with one of the airplane mooring

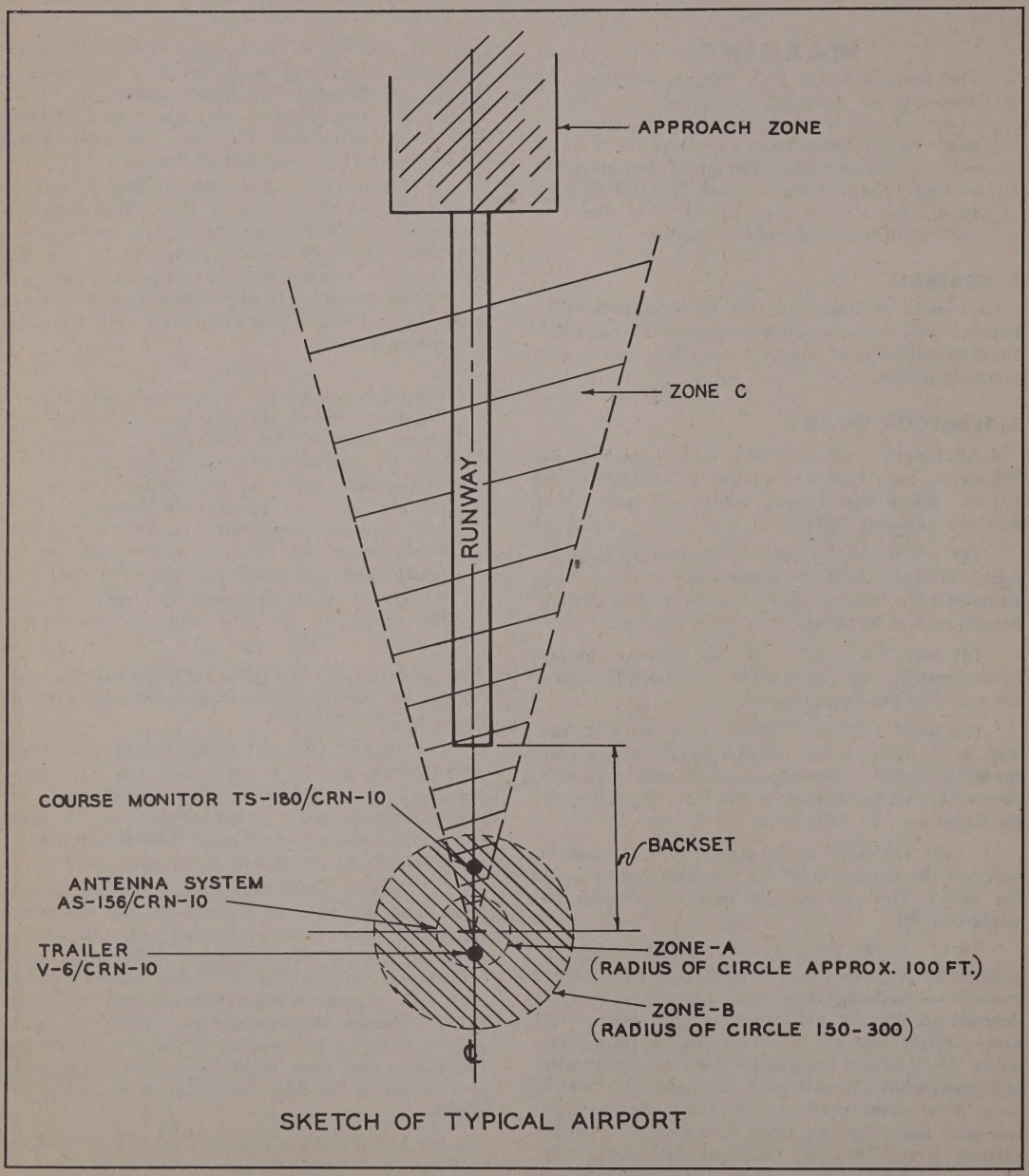


Figure 2-1. Sketch of Typical Airport

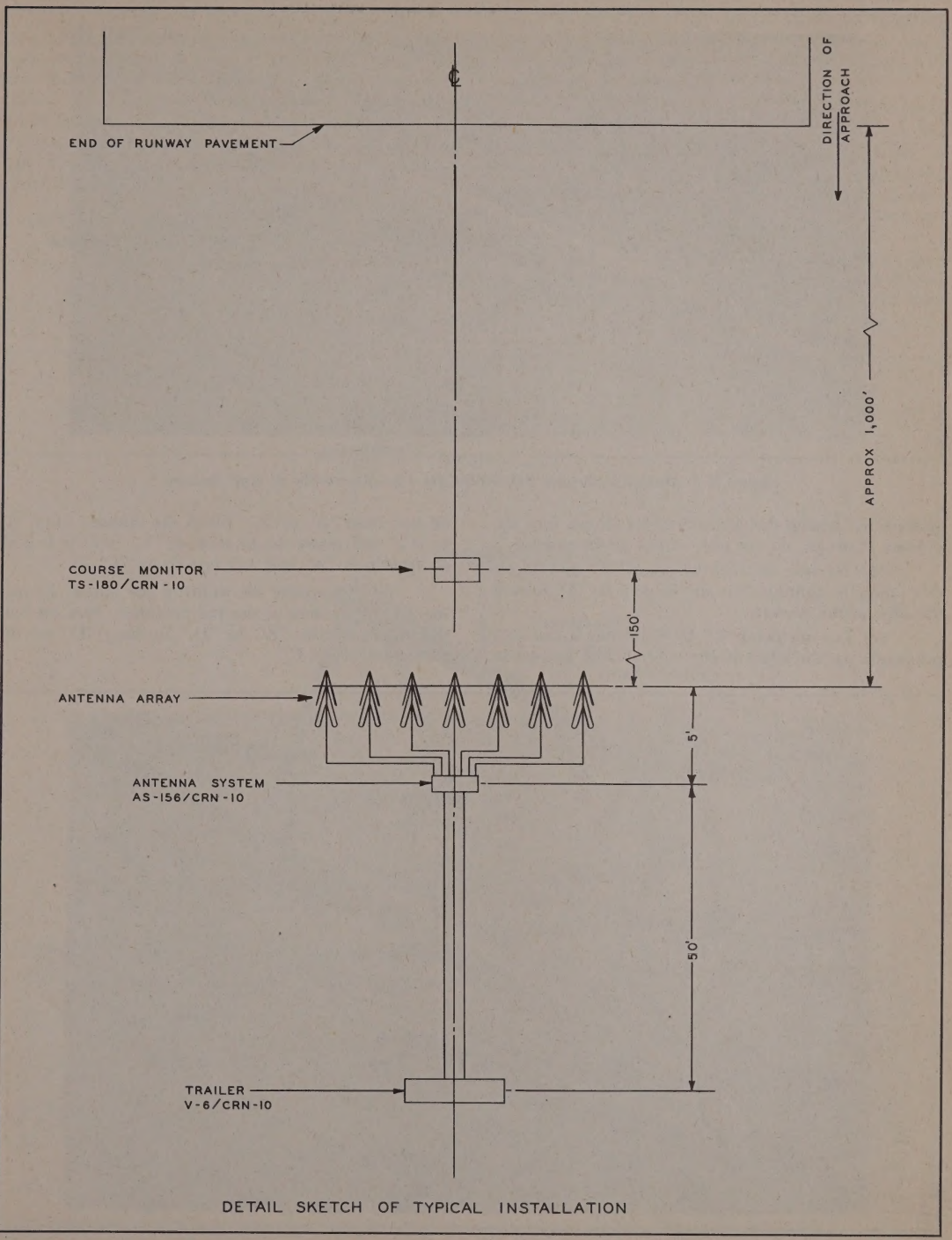


Figure 2-2. Detail Sketch of Typical Installation

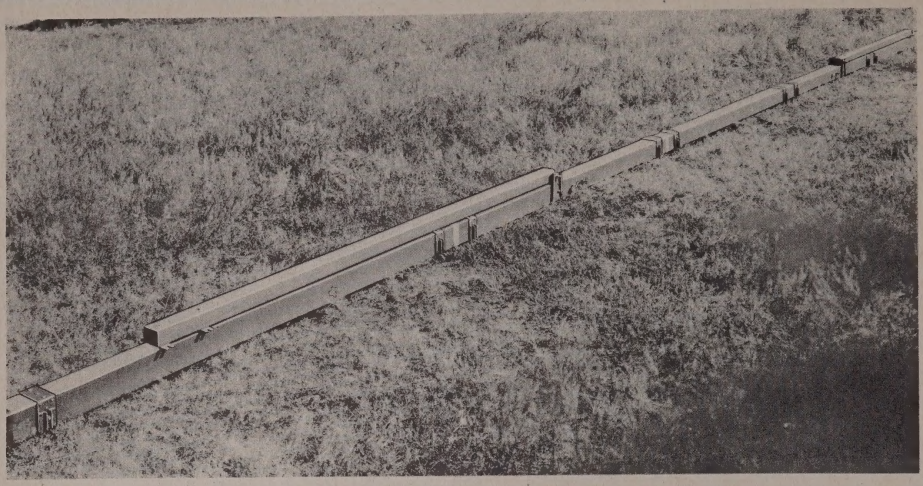


Figure 2-3 Mounting Frame MT-289/CRN-10—Assembly of Half Braces

anchors by driving the arrow half its length into the ground. However, do not lock anchor in the ground.

(b) Measure 80 feet to point "B" and locate this point by sighting over the marker at "A" toward the edge of the runway.

(c) Lay out point "C" by estimating a line perpendicular to the edge of the runway and measuring 60 feet from "A" to "C." Check the distance from "B" to "C," and refine the location of "C" until it is both 60 feet from "A" and 100 feet from "B."

(d) Determine the width of the runway by pacing off the distance across the pavement. Pace off half this distance from "A" to "D," locating "D" on the projection of "A-C."

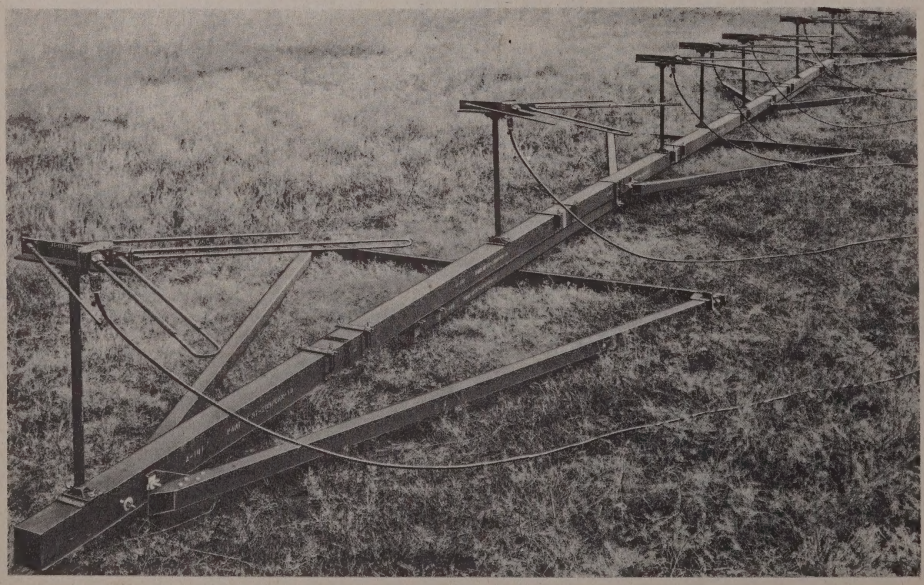


Figure 2-4. Mounting Frame MT-289/CRN-10—Assembled on Ground Prior to Raising

(e) The point of "D" is the location of the center of Antenna Mounting Frame MT-289/CRN-10. The beam of the mounting frame is to be aligned with the line "A-D." Mark point "D" with an airplane mooring anchor. Place airplane mooring anchors along line "A-D" as follows; one 31 feet to the left of point "D" and one 13 feet to the right of point "D." Do not lock the anchors in the ground. This procedure definitely establishes line "A-D."

3. SETTING UP ANTENNA SYSTEM AS-156/CRN-10.

a. PROCEDURE FOR ERECTION OF ANTENNA ARRAY.

(1) Unstrap and remove the antenna stowage container covers. Loosen and remove the metal clamping bars that hold the beam components tightly in place. Unload all items from the containers and carry them to the antenna array site.

(2) Lay all the sleepers at right angles to the array line "A-D" (refer to par. 2.*b.*(2)*(e)* this sec., see fig. 2-6) taking care that the sleepers at the ends are equipped with center brackets for diagonal bracing. Space the sleepers along line "A-D" as shown in fig. 2-6; all must be level with respect to each other. When necessary use Shovel LC-19 and mattock to level the ground.

(3) Bolt one "A" frame member of leg to each end of each sleeper to form four triangular-shaped assemblies. Place these triangular assemblies so that they lie along line "A-D" with their open ends facing to the

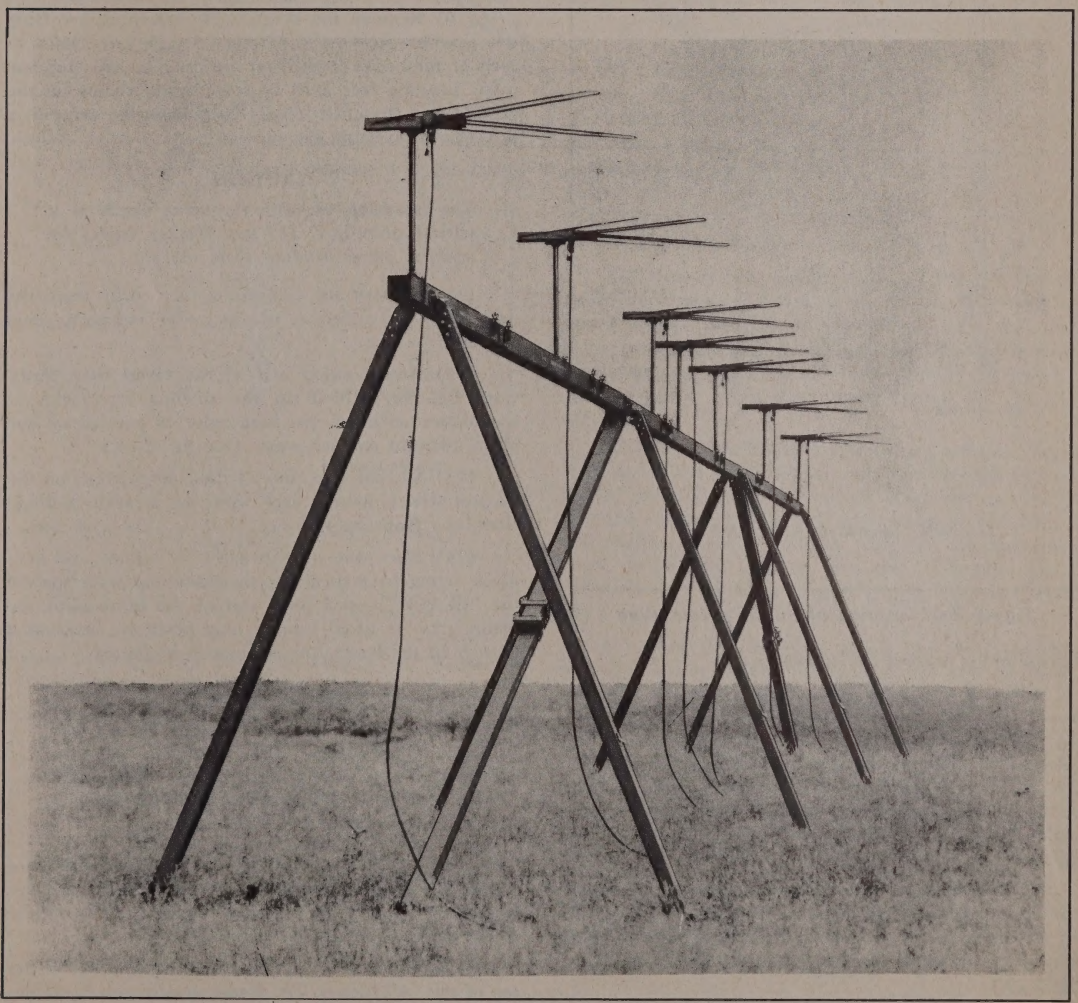


Figure 2-5. Mounting Frame MT-289/CRN-10—Assembled

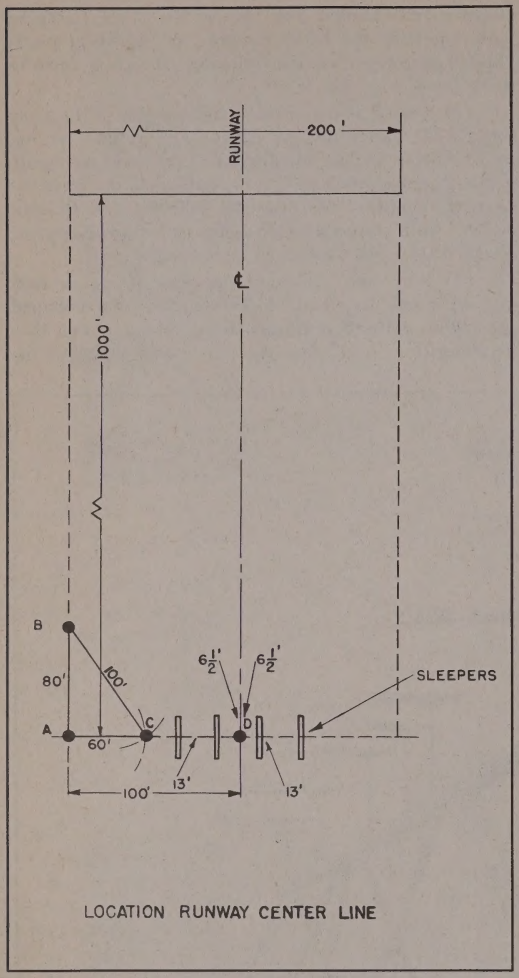


Figure 2-6. Location of Runway Centerline

right looking toward the runway.

(4) Lay all of the square sections of the antenna beam (see fig. 2-8) end-for-end across the end of the runway just back of the "A" frames. Match up the color-coded joints of the sections (see fig. 2-9). Be sure the "RED" coded end of the beam is to the left side of the operator as he faces the runway. Assemble the joints, swing the locking bolts up into locking position, and tighten.

(5) Turn the beam over on its back and bolt either half of a diagonal brace to each end of the two brackets on the underside of the beam. Place each brace so that it points toward its respective end of the beam. (See fig. 2-10.)

(6) Turn the beam right side up and place it down on the "A" frame triangles and clamp each hinge bolt (with the square washer) to the top slot of the nearest "A" frame. (See fig. 2-11.) Back off as far as possible all "A" frame clamping bolts (wing nut and round washer).

(7) Bolt the seven masts to the mooring plates on the top of the beam.

(8) Remove the two antenna storage racks from the trailer. These racks are mounted on Trailer V-6/CRN-10, one in front and one behind the radio transmitter cabinet.

(9) Remove seven Antennas AS-155/CRN-10 from the racks; bolt them to the top of the masts so that the antennas all point toward the runway. Measure the distance between the ends of the three middle antennas to be sure the spacings are exactly equal. (See fig. 2-12.)

(10) Remove the seven cable safety chains from the antenna stowage container. Attach one chain to each of the hooks located on the beam at each antenna mast. Lay the free ends of these seven chains on the ground and stretched loosely back from the array in a direction away from the runway.

CAUTION

The handling of radio-frequency cords is a critical procedure. *Do not damage cables by walking on or bending them sharply.*

(11) Remove the radio-frequency cords from the drawer on the underside of the trailer and carry them to the array site.

(12) Attach either end of the seven color-cords, Cord CG-152/CRN-10 to the antenna receptacles in accordance with the matching color as painted on the beam adjacent to each mast. (See fig. 2-13.)

(13) Lay the free ends of these seven cords on the ground stretch loosely back from the array in a direction away from the run-way.

(14) Place one man at each "A" frame and at a given signal have them lift the beam and walk toward the "BLACK" coded joint end of the beam until the whole array is lifted into its final position. These men must hold the beam until all braces are bolted.

WARNING

When raising the antenna framework one man *must* be assigned to each "A" frame. Each man *must* lift in unison with the others to obtain an even raise. This procedure is necessary to prevent bending of the beam.

(15) Bolt on the other half of each diagonal brace to the half swinging in mid-air and then bolt the lower end of the whole braces to their brackets in the middle of the outer sleepers. (See fig. 2-7.)

(16) Tighten all "A" frame clamping bolts at the top of the "A" frames. The frame should now be rigidly erected. If there is danger of wind, temporarily weight down the array with sand bags.

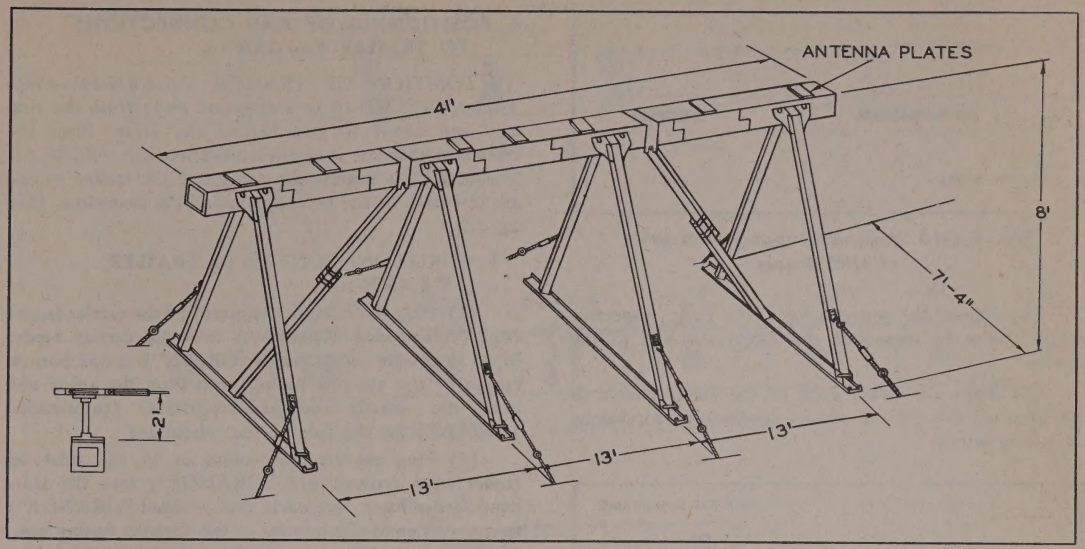


Figure 2-7. Mounting Frame MT-289/CRN-10

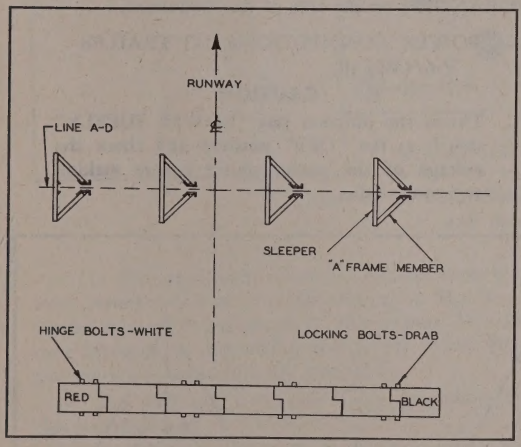


Figure 2-8. Antenna Support—Setting "A" Frames on Ground

b. PROCEDURE FOR SETTING UP ANTENNA TUNING UNIT TN-71/CRN-10.

(1) Remove Antenna Tuning Unit TN-71/CRN-10 from the trailer and stand on its end at the middle of and 5 feet to the rear of the antenna array (on side away from the runway). Be sure that the unit stands on the end nearest to the receptacles coded "ORANGE" and "GREEN." Face the bottom toward the antenna array.

(2) Plug the antenna cord from the antenna coded "red square" to the antenna tuning unit receptacle also coded "red square." Connect all other antenna cords into the antenna tuning unit in accordance with color *and* square or round codings. Plug the antenna cord from the middle antenna into the receptacle coded "BLACK" on the antenna tuning unit. (See figs. 2-13 and 2-14.)

(3) Open the antenna tuning unit legs (folded into the bottom) and carefully stand the unit on these legs.

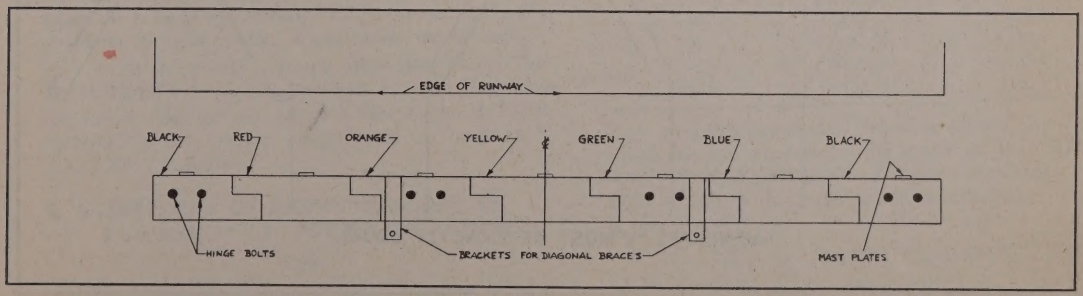


Figure 2-9. Antenna Support—Coding and Assembly of Beam Sections

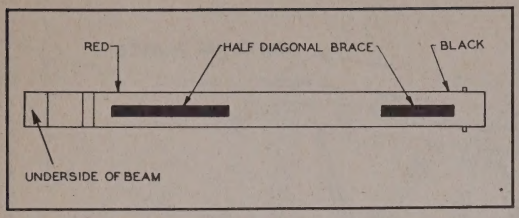


Figure 2-10. Antenna Support—Assembly of Half Braces

(4) Fasten the antenna cords to their respective safety chains by means of the straps attached to the chains.

(5) Stake the lower ends of the safety chains to the ground; this protects the r-f cords under conditions of strong winds.

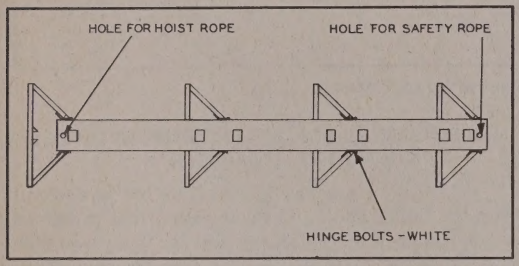


Figure 2-11. Antenna Support—Combining Beam to "A" Frames

4. POSITIONING OF AND CONNECTIONS TO TRAILER V-6/CRN-10.

a. POSITION OF TRAILER V-6/CRN-10.—Place Trailer V-6/CRN-10 in a direction away from the runway and about 50 feet behind the array. Place the trailer so that the intercommunication side (Radio Set SCR-610-A) is nearest the array and the trailer wheels are just back of the prolongation of the centerline. (See fig. 2-2.)

b. CORD CONNECTIONS TO TRAILER V-6/CRN-10.

(1) Plug the straight connector of the carrier feeder cord (color-coded "GREEN") into the carrier feeder input receptacle (color-coded "GREEN") in one bottom corner of the antenna tuning unit. Plug the angle end into the carrier output receptacle (color-coded "GREEN") on the side of the modulator.

(2) Plug the straight connector of the sideband feeder cord (color-coded "ORANGE") into the sideband feeder input receptacle (color-coded "ORANGE") in one corner of the bottom of the antenna tuning unit. (See fig. 2-13.) Plug the angle end of this cord into the sideband output receptacle (color-coded "ORANGE") on the side of the modulator.

c. POWER CONNECTIONS TO TRAILER V-6/CRN-10.

CAUTION

Throw the junction box "POWER SUPPLY" switch to the "OFF" position and check the voltage of the power source before making any connections.

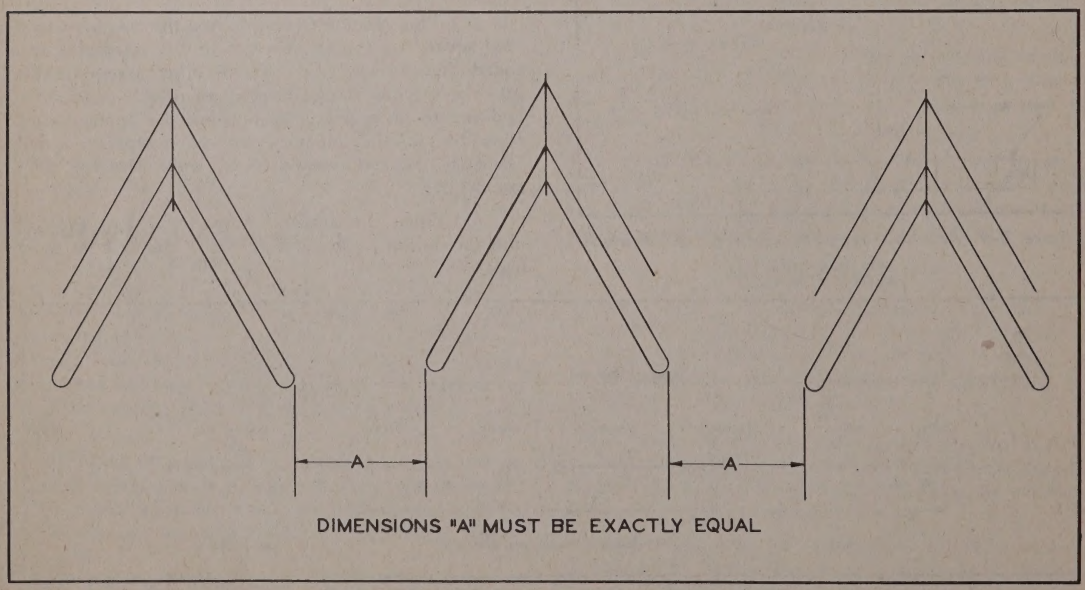


Figure 2-12. Placement of Three Center Antennas

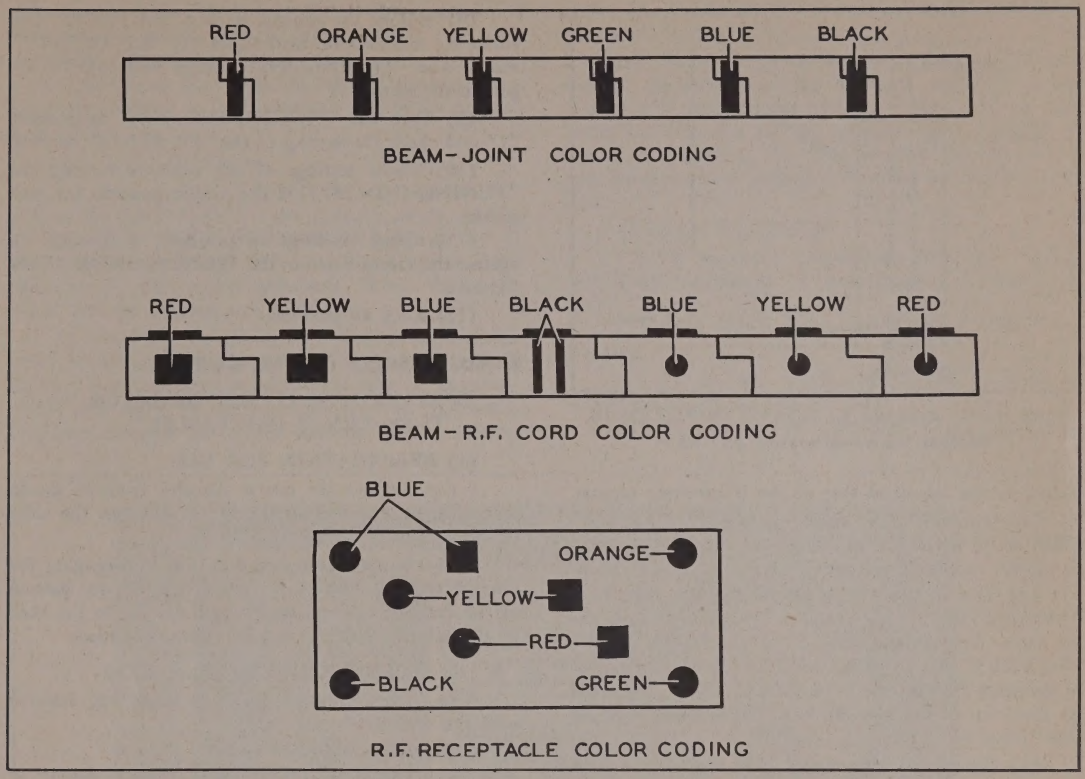


Figure 2-13. Color Coding of Beam Joint, Beam R-F Cord, and Beam R-F Receptacle

(1) The equipment normally operates from a primary power source of 115 volts, 60 cycles. For 50-cycle operation refer to paragraph 11, this section. Two alternate methods of connecting the power source to the transmitter junction box are provided:

(a) Through a 25-foot cable extending from the junction box.

(b) Through terminals on the front of the junction box.

(2) If the power source is Power Unit PU-25/CRN, insert the plug of the 25-foot cord in the receptacle provided on the power unit. Twist clockwise to lock.

(3) If the power source is other than Power Unit PU-25/CRN, such as a commercial 115-volt line, open the lower door of the junction box (marked "TERMINALS") and connect power leads to the "115 V. A.C. EXT." terminals.

5. ADJUSTMENT OF RADIO TRANSMITTER T-66/CRN-10 FOR PROPER OPERATION.

Note

Throw the "ALARM" switch on Indicator ID-70/CRN-10 to the "OFF" position to prevent the alarm bell from ringing during the adjustment of the transmitting equipment.

a. CRYSTALS.—The transmitter is supplied with six crystal units of different frequencies, as indicated in the following table:

Marked Crystal Identification Letter	*Marked Crystal Frequency (kc)*	*Transmitter Output Frequency (mc)*
U	6016.66	108.3
V	6038.88	108.7
W	6061.11	109.1
X	6083.33	109.5
Y	6105.55	109.9
Z	6127.77	110.3

The crystal identification letter is visible through a small circular window in the panel of the "RADIO FREQUENCY SECTION" of Radio Transmitter T-66/CRN-10. Check this letter to see that the proper crystal is being used.

b. TO TURN ON RADIO TRANSMITTER T-66/CRN-10.—Check to see that a source of 115-volt, 60-cycle power is properly connected to the junction box at-

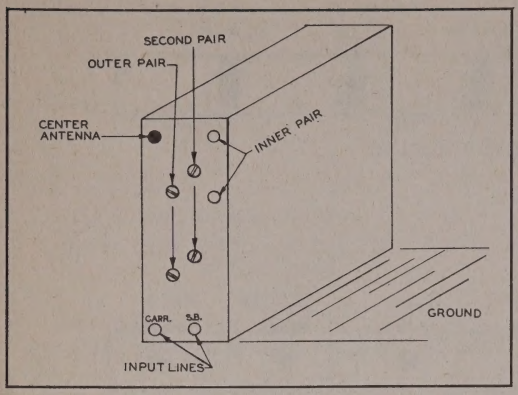


Figure 2-14. Antenna Tuning Unit TN-71/CRN-10 Bottom View—Standing on End

tached to the left-hand side of the transmitter cabinet.

(1) Open the upper door (marked "POWER AND OBSTACLE LIGHT SWITCHES") of the box by loosening the two captive screws.

(2) Throw the "POWER SUPPLY" switch to "GENERATOR" if the power is obtained through the a-c cable from Power Unit PU-25/CRN. Throw the "POWER SUPPLY" switch to "EXTERNAL" if power is obtained through the "115-V. A.C. EXT." terminals on the front of the junction box. The amber "POWER ON" lamp will light.

(3) Throw the transmitter "FILAMENT" switch "ON." The green lamp will light.

(4) Throw the transmitter "PLATE" switch "ON." The red lamp should light 45 seconds after the green lamp lights.

c. TO TUNE RADIO TRANSMITTER T-66/CRN-10.—The radio transmitter will not require retuning unless the crystal is changed. If a crystal is changed refer to sec. V., par. 2.*a.)*, proceed as follows:

(1) Turn the "TUNING INDICATOR SWITCH" to position "3."

(2) With a screw driver loosen the locking screw on the control marked "XTAL OSC." and rotate the control for a maximum reading on the "TUNING IND." meter.

(3) Turn the "TUNING IND. SWITCH" to position "4."

(4) Unlock the control marked "1st MULT. PL." and rotate for a maximum reading on the "TUNING INDICATOR" meter.

(5) Turn the "TUNING IND. SW." to position "5."

(6) Unlock the control marked "2nd MULT. PL." and rotate for a maximum reading on the "TUNING IND." meter.

(7) Turn the "TUNING IND. SW." to position "6."

(8) Unlock the control marked "PA PLATE" and rotate for a maximum reading on the "R.F. OUTPUT" meter. The "TUNING IND." meter will indicate approximate minimum.

(9) Turn the "TUNING IND. SW." to position "7" and check the setting of the "PA PLATE" control.

(10) Check settings of all controls turning the "TUNING IND. SW." to the proper position for each check.

(11) Check readings in positions 3 through 10 against the values listed in the "TUNING INDICATOR CHART."

(12) Lock all controls.

6. ADJUSTMENT OF THE COURSE.

a. OPERATION OF COURSE DETECTOR TS-179/CRN-10 (PORTABLE).

(1) PREPARATION FOR USE.

(a) Remove the course detector from its shock-mounting by unfastening the two catches on the sides of the cabinet.

(b) Mount it on Leg LG-16-B by engaging the pin on the leg bracket with the hole in the bottom of the detector cabinet; then attach the leg to the back of the cabinet with the captive screw provided.

(2) ADJUSTMENT. *(See figure 2-15.)*

(a) For adjustment purposes set up the detector near the trailer.

(b) Raise the front cover.

(c) Throw the right-hand toggle switch to "BATT."

Note

Check the condition of the batteries by observing meter readings with the "MET. SWITCH" in positions "1, 2, 3," and "4." If the meter reads below "70" at any one of these positions, then replace the battery that is low (refer to sec. V).

(d) Turn "MET. SWITCH" to position "6."

(e) Throw the "A.V.C.-M.V.C." toggle switch to "A.V.C."

(f) Release the dial lock on the "OSC. TUNING" control and rotate the dial for a maximum reading on the meter.

(g) Release the dial lock on the "INP. TUNING" control and rotate the dial for a reading of about 100 on the meter.

(h) Readjust the "OSC. TUNING" control for a maximum meter reading.

(i) Lock both dials and turn the battery switch "OFF."

(3) USE OF COURSE DETECTOR.

(a) Carry the detector to a point about 400 feet in front of the antenna array on the centerline of the runway and set it up with its back nearest the array

(the operator will face the antenna array). Attach the antennas and extend them to full length.

(b) Turn on the battery switch.

(c) Using the "INP. TUNING" control bring the meter reading to "70" ("MET. SWITCH" in position "6").

b. COURSE LOCATION.

(1) Turn the "MET. SWITCH" to position "5." Adjust the "A.F. GAIN" control for a meter reading of "70." Turn "MET. SWITCH" to position "7." If the meter does not read "0," move the detector in the direction of the needle deflection. When the meter reads "0," the instrument is on course.

(2) Have one man hold the course detector (portable) in the position where its meter reads zero. Have another man stand 20 feet behind the antenna mounting frame and sight by eye to determine the line where it passes through the center antenna of the antenna array and the center of the course detector (portable). This line is the course.

(3) Align the course so that it falls on the center of the runway at the approach end (where airplanes will make contact with the ground). To do this, shift the left end of the antenna array forward to move the course to the *right,* or shift the left end of the antenna array backward to move the course to the *left.*

c. CLEARANCE CHECK.

(1) To measure clearance, turn the "MET. SWITCH" to position "8" and observe the meter reading.

(2) Then switch to position "9" and observe the reading.

(3) Adjust the "MET. MULT'PR." control to bring the larger reading to "100."

(4) Turn the "MET. SWITCH" to the position at

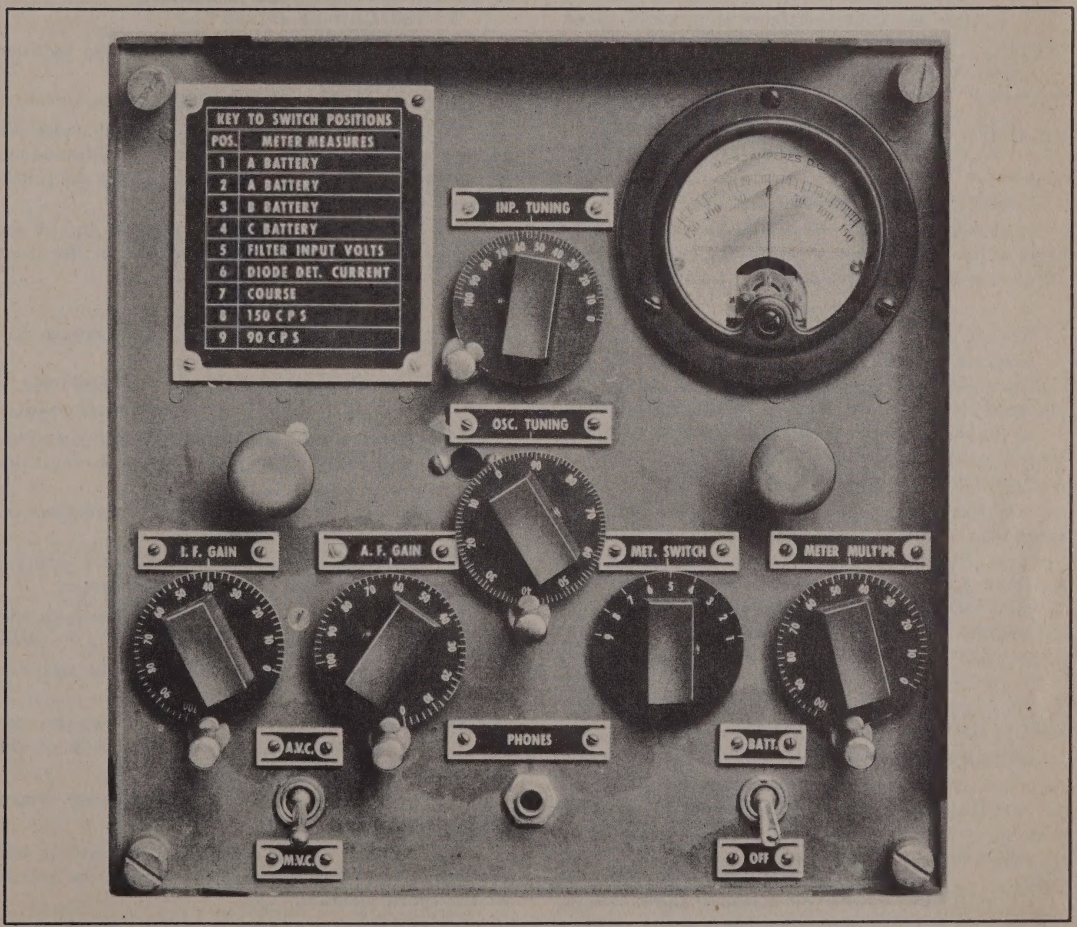


Figure 2-15. Course Detector TS-179/CRN-10—Front Panel View

which the smaller reading was obtained and note the new reading. The ratio of 100 to this reading is a measure of the clearance at the detector location. A clearance calibration curve is located inside the front cover of the instrument.

Note

The setting of the "MET. MULT'PR." control must remain fixed when readings in positions "8" and "9" are compared. Also, the meter must always read "70" with the "MET. SWITCH" in position "5" when making clearance or course measurements.

d. INVESTIGATION OF THE RADIATION PATTERN.—After the desired adjustment of the course is obtained, carry Course Detector TS-179/CRN-10 (Portable) completely around the antenna array at a distance of at least 200 feet from the latter. At each 10-degree interval, set up the course detector and proceed as follows:

(1) After the course detector is properly tuned, with the "MET. SWITCH" on position 6:

(a) Adjust "INP. TUNING" control until the meter reads "70."

(b) Turn "MET. SWITCH" to position "5."

(c) Adjust "A.F. GAIN" control until the meter again reads "70."

(d) Turn the switch to positions "8" and "9."

(e) Adjust "MET. MULT'PR." control until the larger of the two readings obtained in these switch positions is exactly 100 microamperes.

Note

If the smaller deflection is more than 50 microamperes, then a low clearance exists. This indicates that either the system is out of adjustment, or else a neighboring reflecting object is producing some undesired re-radiation. If the smaller reflection is less than 50, the system will be in normal operating condition.

(2) Check the course sharpness by positioning the course detector one degree off course (42 inches off course at distance of 200 feet from truck) and repeat the above procedure. Satisfactory sharpness is indicated if, with "MET. SWITCH" on positions "8" and "9," one reading is 100 and the other is less than 82. Repeat the measurement at a point one degree on the other side of the course. If the smaller of the two readings is greater than 82 at either location, the equipment is not operating properly.

e. ANCHORING ANTENNA ARRAY.

(1) Anchor the antenna array to insure against movement during high wind conditions. Set airplane mooring anchors in the ground at points indicated on figure 2-7 and in accordance with the following procedure:

(a) Remove anchor components, anchor chains, and ground breaking pins from the antenna stowage containers.

(b) Break the ground with Ground Breaking Pin AAF #38B2333* and Hammer HM-1. Assemble an Arrow AAF #36A4467* to an Anchor Rod AAF #36A4468. Slide Driving Rod AAF #36B4466* over the anchor rod resting well down into the crotch of the arrow. Drive the arrow well down into the ground, then twist the driving rod a full quarter turn and pull it off the anchor rod. Screw Eye AAF #36A4469* on the anchor rod. Grasp the eye firmly and pull upward as if to pull the anchor out of the ground. This spreads the anchor and gives it a "bite" in the ground.

(c) Using anchoring chain bracket, hook the "S" hook nearest the turnbuckle in the hole of the "A" frame anchoring bracket. Pass the "S" hook on the other end of the chain through the anchor eye and hook back on itself to take up most of the slack chain. Twist the turnbuckle to make the chain taut. Anchor all "A" frames in a similar manner. (See fig. 2-7.)

7. SETTING UP COURSE MONITOR TS-180/CRN-10 (FIXED).

a. PREPARATION FOR USE.—After the localizer course has been established:

(1) Unreel Cord CX-244/CRN-10.

(2) Extend the cord along the ground under the antenna array to a point approximately 150 feet ahead of the antenna array on front course. This is the course monitor position.

(3) Connect the right-angle connector end of the cord to the socket on the left-hand side of the front panel of Indicator ID-70/CRN-10.

(4) On the indicator box:

(a) Set the "SENSITIVITY" dial between "3" and "5."

(b) Set "COURSE" switch to mid position.

(c) Set the "ALARM" switch in the off position.

(5) Obtain one of the airplane mooring anchors and the tripod anchor chain from antenna stowage containers.

(6) Remove the tripod from its storage place on the trailer.

(7) Carry the course monitor, the tripod, and the anchor and chain to the course monitor position.

(8) Extend the tripod legs as far as the stops will permit and clamp the legs with thumb screws provided.

(9) Spread the tripod legs as far as the retaining chains will permit and set up the tripod.

(10) Remove the protective cover from the tripod head and screw the tripod into the ring on the bottom of the course monitor.

(11) Face the front of the course monitor toward the antenna array.

(12) Connect the straight connector on the end of Cord CX-244/CRN-10 to the socket on the bottom of the course monitor.

*Part of the case assembly (mooring anchors), Air Corps Stock No. 8200-147000.

(13) Remove the antenna rods from their storage clips on the course monitor.

(14) Extend them as far as they will go and secure them in the chucks provided on the top of the course monitor.

b. ADJUSTMENT.—Remove the front cover of the course monitor.

(1) Press the push-button marked "TUNING" and slowly vary the "DETECTOR TUNING" dial for maximum deflection on the "COURSE METER."

(2) Lock the "DETECTOR TUNING" dial after tuning is completed.

(3) Release the "TUNING" push-button and read the "COURSE" meter. If the "COURSE" meter does not read zero, the course monitor, including the tripod will have to be positioned until the meter reads zero.

(4) After the course monitor is properly positioned, anchor it in place by means of the chain between the eye on the head of the tripod and the anchor or a sandbag, or some other heavy weight.

(5) Replace the front cover of the course monitor.

8. ADJUSTMENT OF INDICATOR ID-70/CRN-10.

After Course Monitor TS-180/CRN-10 (Fixed) has been adjusted:

a. Remove the protective cover from the indicator box.

b. Adjust the "SENSITIVITY" dial to give a reading on the red index mark on the "FILTER INPUT" meter.

c. Throw the "ALARM" switch to "ON."

d. Replace the protective cover on the indicator box.

9. SETTING UP OBSTACLE LIGHTS.

Remove the obstacle-light assembly from the top of the trailer and insert the standard in the socket provided at the right rear corner of the trailer. Connect the cord to the similar cord extending from the transmitter junction box.

a. CONNECTIONS FOR OPERATION FROM 115-VOLT A-C SOURCE.

(1) Remove the red lenses and check the insertion of 105-volt bulbs in the sockets.

(2) Throw the junction box "POWER SUPPLY" switch to "GENERATOR" if power is obtained through the junction box a-c cable, or to "EXTERNAL" if the power souce is connected to the "115-V. A.C. EXT." terminals on the front of the junction box.

(3) The "POWER ON" lamp will light when the proper connection is made.

(4) Turn the "OBSTACLE LIGHTS" switch to the "115-V. A.C." position.

Note

It will be necessary to depress the safety catch on the "OBSTACLE LIGHTS" switch to do this.

b. CONNECTIONS FOR OPERATION FROM 12-VOLT BATTERY.

(1) Turn "OBSTACLE LIGHTS" switch "OFF." Insert eight 12-volt bulbs in sockets.

(2) Connect the lugs of the 25-foot cord attached to the junction box to the battery terminals of Power Unit PU-25/CRN, observing polarity.

(3) Turn "OBSTACLE LIGHTS" switch to the "BATTERY" position. The "POWER SUPPLY" switch may be left in any position.

c. CONNECTIONS FOR OPERATION FROM 105-VOLT D-C AIRPORT RUNWAY SUPPLY.

(1) Insert 105-volt bulbs in the sockets.

(2) Connect the 105-volt source to the junction box terminals marked "105-V. D.C. EXT."

(3) Turn the "OBSTACLE LIGHTS" switch to the "RUNWAY SOURCE" position.

Note

It will be necessary to depress the safety catch on the "OBSTACLE LIGHTS" switch to do this.

(4) The "POWER SUPPLY" switch may be left in any position.

10. SETTING UP FOR REMOTE OPERATION.

For remote operation of the equipment it is necessary to have a source of approximately 48 volts d-c in series with a single-pole, single-throw switch at the remote point.

a. Throw transmitter "FILAMENT" switch "OFF."

b. Throw transmitter "PLATE" switch "ON."

c. Open the transmitter junction-box door marked "TERMINALS" and connect the remote line to the terminals marked "48-V. D.C. EXT."

d. Throw the junction-box "POWER SUPPLY" switch to "GENERATOR" or "EXTERNAL," depending upon the source of power available. When the "POWER ON" lamp lights, the equipment is ready for remote operation.

11. OPERATION FROM 50-CYCLE SUPPLY.

A 50-60 cycle Frequency Converter PU-15/CRN-2 is needed in order to supply power at 60 cycles to the motor of Modulator MD-24/CRN-10.

a. Remove the cable from the "60-CYCLE POWER INPUT" receptacle of the modulator, and attach the AN connector of Cord CX-346/CRN-10 to the modulator.

b. Connect the lugs on the other end of Cord CX-346/CRN-10 to the "GENERATOR" terminals of the frequency converter.

c. Join the AN connectors of Cord CX-345/CRN-10, and of the cable removed from the modulator (one end of which is still attached to the junction box).

d. Connect the lugs of Cord CX-345/CRN-10 to the "MOTOR" terminals of the frequency converter.

e. See that "MOTOR" is strapped for 115 volts.

f. Connect the terminals of the 50-cycle power source to the "115-V A.C. EXT." terminals on the transmitter junction box.

g. Throw the junction-box "POWER SUPPLY" switch to "EXTERNAL."

SECTION III
OPERATION

1. OPERATION OF RADIO SET AN/CRN-10.

a. TO START THE EQUIPMENT.

(1) OPERATION FROM GENERATOR PU-25/CRN.

(a) Follow instructions stated on the control panel of Generator PU-25/CRN.

(b) Open the upper door of the transmitter junction box and throw the "POWER SUPPLY" switch to "GENERATOR" position. The equipment is in operating condition.

(2) OPERATION FROM COMMERCIAL POWER (115-VOLT 50- OR 60-CYCLE A.C.).—Open the upper door of the transmitter junction box and throw the "POWER SUPPLY" switch to "EXTERNAL." The equipment is in operating condition.

(3) OBSTACLE LIGHT OPERATION, BATTERY SUPPLY.—The transmitting equipment is located on an airport which has no 105-volt d-c runway supply.

CAUTION

Check the voltage rating of the obstacle light bulbs to be sure that 12.8-volt bulbs are in the sockets.

Open the upper door of the transmitter junction box and turn obstacle light switch to "BATTERY" position. The obstacle lights will light.

(4) OBSTACLE LIGHT OPERATION, 105-VOLT D. C. RUNWAY SUPPLY.—The transmitting equipment is located on an airport which has a 105-volt d-c runway supply available for obstruction light use.

CAUTION

Check the voltage rating of the obstacle light bulbs to be sure that 105-volt bulbs are in the sockets.

Open the upper door of the transmitter junction box and turn the obstacle light switch to "RUNWAY SOURCE." The obstacle lights will light.

b. TO STOP THE EQUIPMENT.

(1) GENERATOR PU-25/CRN.

(a) Throw the "POWER SUPPLY" switch to "OFF."

(b) Press "STOP" pushbutton on Generator PU-25/CRN.

(2) COMMERCIAL POWER (115-VOLT, 50- OR 60-CYCLE A.C.).—Throw "POWER SUPPLY" switch to "OFF."

2. OPERATION OF RADIO RECEIVER AND TRANSMITTER BC-659-(*).

This receiver and transmitter is part of Radio Set SCR-610-A.

a. TO START THE EQUIPMENT.

(1) Turn the "VOLUME" control knob on all the way.

(2) Turn the meter switch to "OPER."

(3) Turn the channel selector control marked "CHAN" to the channel on which communication is to be made. Listen for the station with which communication is desired.

(4) Regulate the "VOLUME" control to the desired level.

(5) To transmit, press the switch on handset and speak clearly into the microphone. Release when transmission is complete.

b. TO STOP THE EQUIPMENT.—To turn off the radio set, turn "VOLUME" to the "OFF" position.

*Refers to any production model of the equipment.

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SECTION IV
EMERGENCY OPERATION AND REPAIR

CAUTION

Before replacing any fuses, tubes, or indicator lamps in this equipment, disconnect all input power by throwing the "POWER SUPPLY" switch to the "OFF" position. This switch is located behind the upper door of the transmitter junction box. Be sure that the replacement fuses, tubes, or lamps are the same type and size as the ones removed.

1. INDICATOR ID-70/CRN-10.

a. REPLACEMENT OF FUSES.—The fuses are accessible at the two holders at the top center of the panel.* To open fuse container turn knob in counterclockwise direction and pull out.

(1) Defective fuse indications and replacement are as follows:

Symptom	*Replace Fuse*
Normal course exists. No reading "COURSE" meter. No reading "FILTER INPUT" meter.	F-402 (right hand fuse)
"FILTER INPUT" meter reading normal. "ALARM ON" light not lighted with the "ALARM" switch in "ON" position	F-402 (left hand fuse)

b. REPLACEMENT OF INDICATOR LAMPS.

(1) To gain access to the lamp bulbs in the "ALARM ON" and "ALARM" indicator lamp assemblies, twist the lens holder counterclockwise and then withdraw the bulbs.

(2) To gain access to the lamp bulbs in the other indicator lamp assemblies extract the lens holder with the aid of the cap extracting tool, which is mounted in clips at the upper left of the chassis just behind the panel.

(3) Defective lamp indications and replacement are as follows:

Symptom	*Replace Lamp*
"FILTER INPUT" meter reads normal. "ALARM ON" lamp not lighted. Fuse F-402 (left hand) is good.	"ALARM ON" (green)
Alarm bell rings. Red "ALARM" light not lighted.	"ALARM" (red)
"FILTER INPUT" meter does not read. "COURSE OFF" light not lighted. "ALARM" light not lighted.	"COURSE OFF" (small amber)
"COURSE" meter reads 20 or more. "COURSE" meter reads left. Red "COURSE" light not lighted.	"COURSE" (small red—left)
"COURSE" meter reads 20 or more. "COURSE" meter reads right. Green "COURSE" light not lighted.	"COURSE" (small green—right)

c. REPLACEMENT OF TUBES.

(1) All of the tubes in the indicator box except the metal JAN-6H6 tube have spring locking devices which must be released to remove the tube from the socket. The locking device on the JAN-6H6 tube releases automatically.

(2) Defective tube indications and replacement are as follows:

Symptom	*Replace Tube*
Normal course exists.	JAN-6K6GT
Fuse F-401 (right hand) good.	JAN-6X5GT
Meter M402 reading not normal.	(Replace one at a time)
"FILTER INPUT" meter reads zero.	JAN-2051
"ALARM" bell does not ring.	JAN-6H6 (Replace one at a time)

Note

If when the "ALARM" bell rings and the "ALARM" indicator light (red) lights and the trouble is not located in the indicator, it may be due to trouble in radio transmitter.

2. RADIO TRANSMITTER T-66/CRN-10.

a. TO CHANGE CRYSTALS.

(1) Move "POWER SUPPLY" switch to "OFF" position.

(2) Swing open the front cover of the transmitter after unfastening the three catches on one side; or, remove the cover by unfastening the catches on both sides. Unscrew the two knurled knobs of the "RADIO FREQUENCY SECTION."

*Spare tubes and indicator lamp bulbs are stored in Chest CY-184/CRN-10, located on the rear of the mechanical modulator front panel. Spare fuses are carried in the tool box.

(3) Depress the spring-stop on the right side of the chassis, and pull out the section about halfway. The five spare crystals are mounted in sockets along the left side of the chassis.

(4) Select the desired crystal and exchange it with the one in the operating socket (front, center).

(5) Replace the section and tighten the screws.

b. TO REPLACE FUSES.—To gain access to the fuses on both shelves of the transmitter, swing open or remove the rear cabinet cover.

(1) Three fuses (two for filament and one for bias transformers) are located at the upper right rear edge of the "RADIO FREQUENCY" section (upper shelf).

(2) Four fuses (one for blower motor, two for plate, and one for filament transformers) are located on the rear left side of the "POWER SUPPLY" section (lower shelf).

(3) Defective fuse indications and replacement are as follows:

Symptom	*Replace Fuse*
Equipment operating normally. Blower does not operate	F-101 (lower shelf)
"TUNING IND." meter does not read in "TUNING IND. SW." position 8. Tube filaments 836 tubes lighted (V102, V103, V104, and V105)	F-102 (lower shelf)
"TUNING IND." meter does not read in "TUNING IND. SW." position 8. Tube filaments 836 tubes (rectifiers) not lighted (V102, V103, V104, and V105).	F-103 (lower shelf)
"TUNING IND." meter does not read in "TUNING IND. SW." position 9. Tube filaments 836 tubes (rectifiers) not lighted (V102, V103, V104, and V104).	F-104 (lower shelf)
"TUNING IND." meter does not read in "TUNING IND. SW." position 5. Filaments of tubes V109 and V110 not lighted.	F-105 (upper shelf)
"TUNING IND." meter does not read in "TUNING IND. SW." positions 3 or 4. Crystal Light I104 not lighted. Filaments of tubes V101, V106, V107 and V111 not lighted.	F-106 (upper shelf)
"TUNING IND." meter does not read in "TUNING IND. SW." position 10. Filament of tube V108 not lighted.	F-107 (upper shelf)

(4) Replace the rear cover of the radio transmitter cabinet.

c. REPLACEMENT OF INDICATOR LAMPS.

(1) To gain access to overload indicator lamp I101 and crystal holder lamp I104, loosen the captive panel screws and draw out the shelf which contains the defective indicator lamp assembly.

(2) The following table lists defective indicator lamp symptoms and replacement:

Symptom	*Replace Lamp*
Meter protection relay K101 closed. Overload indicator lamp I101 not lighted.	I101 (upper shelf)
Blower operating. Filament "ON" lamp I102 not lighted.	I102 (lower shelf)
Equipment operating normally. Plate "ON" lamp I103 not lighted.	I103 (lower shelf)
Equipment operating normally. Filaments of tubes V101, V106, V107, and V111 lighted. Crystal holder lamp I104 not lighted.	I104 (upper shelf)

(3) To replace lamps I102 and I103, turn the lens mount counterclockwise and withdraw it. Push the bulb in and turn it counterclockwise to release the bayonet lock. Pull out the bulb and insert another by pushing in and turning clockwise. Replace the lens and lock it by turning clockwise.

(4) To replace lamps I101 and I103 loosen the captive screws and withdraw the upper shelf. Push the bulb in and turn it counterclockwise to release the bayonet lock. Pull out the bulb and insert another by pushing in and turning clockwise. Push the shelf back into position and tighten the captive screws.

d. REPLACEMENT OF TUBES.—To gain access to all radio tubes it is necessary to loosen the captive panel screws and draw out the shelf which contains the defective tube. *Follow* the detailed tube-removal instructions given in sub-paragraphs (3) to (8) following. Replace tubes when filaments do not light or tube voltages are low.

(1) To replace tubes V102, V103, V104 or V105:

(a) Remove the top tube connection.

(b) Turn the tube counterclockwise and withdraw it.

(c) Insert another tube, fitting the pin in the socket and turning clockwise.

(d) Replace the tube cap.

(2) To replace tubes V101 and V106:

(a) Remove the top tube connection.

(b) Press down the spring clamp at the base and pull the tube straight out.

(c) Insert another tube pushing down firmly.

(d) Replace the tube cap.

(3) To replace tube V108:

(a) Press down the spring base clamp and pull the tube straight out.

(b) Insert another tube pressing down firmly.

(4) To replace tube V111:

(a) Pull the tube straight out.

(b) Insert another tube pressing down firmly.

(5) To replace tube V107:

(a) Remove the top connection.

(b) Pull the tube straight out.

(c) Insert another tube, pressing down firmly.

(d) Replace the top connection.

(6) To replace tubes V109 or V110.

(a) Remove the top of the shield by releasing the three captive screws.

(b) Remove the top tube connection.

(c) Loosen the "LOCK-RELEASE" thumbnut, move and hold in the "RELEASE" direction; at the same time pull the tube straight out.

(d) Insert another tube, pressing down firmly and allowing the thumbnut to return to the "LOCK" position. Tighten the nut.

(e) Replace the top tube connection.

(f) Replace and fasten the shield cover.

e. CRYSTAL FAILURE.—If a crystal unit is thought to be defective, remove it from the operating socket in the "RADIO-FREQUENCY SECTION" and from the spare parts box, replace it with one having the same identification letter.

f. JUNCTION BOX.

(1) REPLACEMENT OF FUSES.

(a) To gain access to the five fuses used in the transmitter-junction box, release the four captive screws and remove the top cover marked "FUSES."

(b) Defective fuse indications and their replacement are as follows:

Symptom	*Replace Fuse*
With 115 volts, 60 cycle a. c. connected. With "POWER SUPPLY" switch properly thrown. No indicator lights on equipment lighted. Modulator motor not operating.	F-201 and F-202
With obstacle light switch thrown to "115 VOLTS." Radio equipment operating. Obstacle lights not lighted.	F-203
With obstacle light switch thrown to "BATTERY." With battery supply properly connected. Obstacle lights not burning.	F-204
With obstacle light switch thrown to "RUNWAY SOURCE." With runway supply properly connected. Obstacle lights not burning.	F-205

(c) Replace transmitter-junction box cover and tighten the four captive screws after changing fuses.

(2) REPLACEMENT OF INDICATOR LAMP.—With the equipment operating normally but "POWER ON" indicator lamp not lighted, replace indicator lamp bulb in the following manner:

(a) Turn the lens mount counterclockwise and pull it out.

(b) Push in the bulb and turn it counterclockwise to release.

(c) Withdraw defective lamp bulb and insert another, pushing it in and turning clockwise.

(d) Replace the lens and turn it clockwise to lock.

3. POWER CABLE FAILURES.

A cut or damaged power cable may be temporarily repaired by splicing and taping the wires as follows, being careful to maintain correct polarity.

a. If the cable is not completely severed at the damaged part, make a clean cut, trimming both ends back as far as necessary.

b. Remove the outer rubber jacket for a distance of about 3 inches, taking care not to damage the covering of the individual conductors.

c. Remove the insulation from the individual conductors for a distance of about ¾ of an inch.

d. Match the colors of the individual conductor from each end of the splice; twist the strands of the matched conductors together to make a neat and strong mechanical splice.

e. Solder each conductor splice.

f. Apply 2 to 3 inches of ¼-inch rubber tape to each splice, stretching the tape as it is wrapped on the wire.

g. Apply 2 to 3 inches of ¼-inch friction tape to each splice.

h. Apply a complete and tight-fitting covering of ½- to ¾-inch rubber tape over the entire exposed portion of the cable; extend it about 2 inches beyond each end of the exposed cables.

i. Apply a complete tight-fitting covering of friction tape over the rubber tape.

4. COURSE DETECTOR TS-179/CRN-10 (PORTABLE).

a. REPLACEMENT OF BATTERIES.

(1) To change any one of the five batteries used in the portable course detector:

(a) Remove the rear cabinet cover.

(b) Disconnect the defective battery.

Note

It is necessary to remove one of the batteries (Battery BA-63) or both Batteries BA-15-A before withdrawing Battery BA-2 or Battery BA-63 located in the corner.

(2) Following is a list of defective battery indications and replacement:

Symptom	*Change*
Meter reads less than 70 with "MET. SWITCH" in position 1.	Battery BA-15-A (left hand battery)
Meter reads less than 70 with "MET. SWITCH" in position 2.	Battery BA-15-A (right hand battery)
Meter reads less than 70 with "MET. SWITCH" in position 3.	Battery BA-63 (left hand batteries)
Meter reads less than 70 with "MET. SWITCH" in position 4.	Battery BA-2 (center battery)

(3) Check connectors after replacing batteries to be sure contacts are good. Replace the rear cabinet door.

b. REPLACEMENT OF TUBES.

(1) To gain access to all radio tubes it is necessary to remove the chassis from the cabinet as follows:

(a) Raise the front cover of the instrument.

(b) Loosen the four corner captive screws.

(c) Pull chassis out to the end of the rails.

(d) For access to tube V601 remove shield can in center of chassis.

(e) Tubes V603 and V604 are locked in their sockets by spring action; a little force may be required to remove them and insert new ones.

(2) If normal operation is not obtained and the batteries test "good," replace the tubes one by one with known good ones.

5. MODULATOR AND BRIDGE MD-24/CRN-10.

a. REPLACEMENT OF INDICATOR LAMP.

(1) If the modulator motor operates, but the "PILOT LIGHT" does not light, change the lamp bulb as follows:

(a) Turn the lens mount counterclockwise and withdraw it.

(b) Push the bulb in and turn it counterclockwise to release the bayonet lock.

(c) Pull out the bulb and insert another by pushing it in and turning it clockwise.

(d) Replace the lens, turning it clockwise to lock.

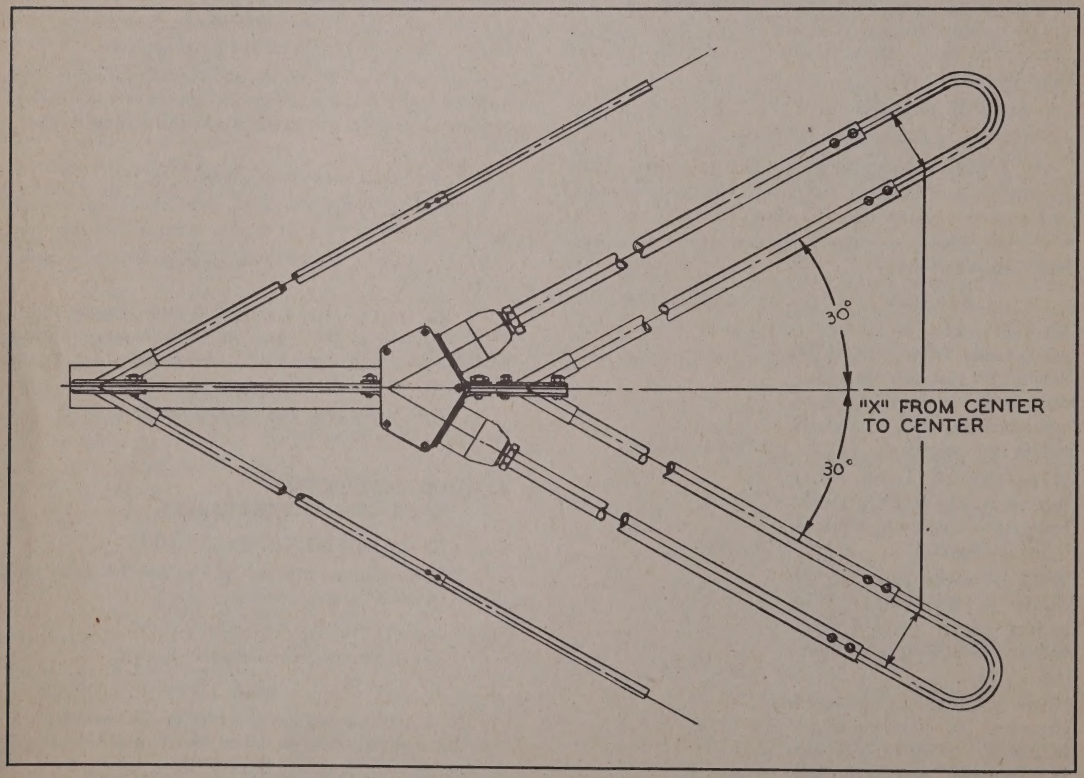

Figure 4-1. Antenna AS-155/CRN-10

6. OBSTACLE LIGHT ASSEMBLY.

a. REPLACEMENT OF LAMP BULBS.—To change burned out obstacle light bulbs proceed as follows:

(1) Release the catch on the lens retainer ring.

(2) Remove both retainer ring and red plastic lens.

(3) Press down on bulb and turn counterclockwise to release bulb.

(4) Withdraw burned out bulb and insert a new one, pressing down and turning clockwise to lock.

(5) Replace lens and locking ring.

b. TEMPORARY REPAIR OF DAMAGE.—The obstacle light support is a ⅜-inch iron pipe. If this pipe is bent, it can be straightened without difficulty. If it is broken a temporary wood or metal rod can be strapped or bolted to the remaining part of the assembly. If the cable becomes damaged beyond repair, open the small junction box and connect temporary power leads to the terminals inside.

7. COURSE MONITOR TS-180/CRN-10 (FIXED).

a. REPLACEMENT OF TUBES.

(1) To gain access to the tube in the course monitor, remove the rear cover of the cabinet.

(2) *Carefully* pull the tube from the socket.

(3) *Carefully* push the known good tube into the socket.

8. CORD CX-244/CRN-10.

If Cord CX-244/CRN-10 becomes damaged, make emergency repairs by following the instructions in paragraph 3, this section.

9. ANTENNA SYSTEM AS-156/CRN-10.

a. ANTENNA MOUNTING FRAME.—Any of the wooden members of the antenna mounting frame can be repaired by nailing or lashing wooden splints to the broken member. The aluminum masts may be straightened if they are bent, or they may be replaced with a temporary metal or wooden piece.

CAUTION

Antenna AS-155/CRN-10 must be supported at the spacings shown in figure 4-1. Each antenna must be arranged so that no antenna is displaced from the line of the array or is twisted on its mast, except the center antenna, which is intentionally mounted 2 inches forward.

b. ANTENNA. — A deformed antenna may be straightened by bending the radiating rods. Maintain the dimensions shown in figure 4-1. *Do not change* the lengths of the radiating rods, for they are pinned at the proper length.

SECTION V
SUPPLEMENTARY DATA

1. ABRIDGED UNITED STATES-BRITISH GLOSSARY OF AERONAUTICAL AND RELATED NOMENCLATURE.

United States	*British Equivalent*	*Definition*
Airport, airfield, or airdrome	Aerodrome	A definite and limited area of ground or water intended to be used in connection with the arrival, departure and servicing of aircraft.
Antenna	Aerial	A conductor consisting of a wire or wires supported in the air for directly transmitting or receiving electric waves.
Battery, storage	Storage battery or accumulator	A battery of leakproof design which will not discharge its liquid contents during violent maneuvers.
Converter	Converter or motor generator (AC to DC)	A motor coupled to a generator for transforming electric currents (cf inverter).
Left	Port	Situated to the left, looking in the direction of motion of an aircraft.
Mast, radio	Rod aerial	A mast attached to an aircraft which serves as part of the radio antenna structure.
Navigation, air or aerial navigation	Avigation	The guidance of craft through the air in accordance with previous calculation. "Avigation" has been used, but is considered unnecessary in the United States.
Radio	Wireless	A device for the transmission or reception of signals by means of electric waves.
Right	Starboard	Situated to the right, looking in the direction of motion of an aircraft.
Runway or landing strip	Runway	An oriented path within the effective landing area along which aircraft arrive and depart.
Tube	Valve	A radio electron tube.